DOCKET FILE COPY ORIGINAL

Before the

FEDERAL COMMUNICATIONS COMMISSION

WASHINGTON, D.C. 20554

In the Matter of

GEN Docket No. 90-314
ET Docket No. 92-100

Amendment of the Commissions's Rules to Establish New Personal Communications Services

JUL 20 1993

To: The Commission

COMMENTS OF COMRAD & MATRIX CORPORATIONS REGARDING PROPOSALS OF WINFORUM CONCERNING UNLICENSED PCS

WINForum has performed a major service for America. WINForum has called attention to an important need for unlicensed spectrum for a new variety of uses. WINForum has also performed an important service for America by identifying the need for "Spectrum Etiquette.

ComRad Corporation's goal is to research and promote the most spectrally efficient technologies for cellular, PCS and similar radio communications systems. ComRad and her sister Company, Matrix, have been researching radio technology for many years. Lately, ComRad Corporation has been writing computer simulation programs to evaluate different spectrum sharing protocols.

Our company has four awarded patents. These patents all offer new technology that increases spectrum efficiency, and these patents all reduce the dropped call rate. One patent explains signal to interference calculations in centralized systems such as cellular systems. Another explains signal to interference calculations in decentralized systems such as being advocated by WINForum. Another explains spread spectrum dynamic code allocation to eliminate similar codes from causing interference. Our company offers to help any governmental agency or private company understand the complex relationships involved in

advanced spectrally efficient technology.

Before commenting on the technology issues raised in the WINForum spectrum etiquette proposals, ComRad Corporation would like to observe that the vast majority of the American public feel that the Washington establishment including the president of the United States, his staff, the congress, and the administrative agencies, and the supporting private and public bureaucracies in Washington are no longer governing in an effective manner.

Comments on Spectrum Allocation

Consider for a moment that the United States has an enormous trade deficit. The USA leadership in computer and cellular radio technology is saving this country from an even bigger disaster in trade balance. ComRad would personally like to congratulate companies such as IBM, Intel, Motorola, Apple, and others for their contribution to saving the USA from an even bigger trade deficit. ComRad also notes that many small and medium sized technological companies are also helping to reduce our trade deficit. ComRad would also like to note that it is these same companies that are trying to establish a band of frequencies for unlicensed new technologies.

Consider for a moment that the lowest frequencies are the most useful. Some of the Amateur Radio bands can talk to Australia, for example, while frequencies in the cellular radio band have difficulty reaching to the edge of their cells. If you observe that many technicians believe that the upper limit for many kinds of radio service is at about 2,000 megahertz, then you can see that the 20 megacycle band being proposed for unlicensed PCS is only **one percent** of the total valuable frequencies.

If the United States government thinks that technological America can lead the world with only one percent of the available frequencies for new computer technology such as student data entry devices, cordless PBXs, computer radio networks, cordless keyboards, and a host of other new devices such as second generation cordless phones, it is no wonder that the average consumer feels that the governmental process is failing.

The average personal computer today has a clock speed of over 15 megacycles, and that clock speed applies to several parallel wires each running at full speed. The typical personal computer sold today, can not keep up with the new high tech Graphical User Interfaces (GUIs) without even higher clock speeds. A rule of thumb is that the bandwidth required to transmit information is closely related and about equal to the speed of the information. This means that the proposed 20 megacycles of bandwidth would

megacycles wide, this is not surprising.

Furthermore, the Federal government is now writing legislation to sell radio spectrum to the high tech companies (A TAX) for PCN. On the other hand, the broadcast television industry controls hundreds of megacycles of desirable spectrum. Not only is our federal government going to tax new technology for limited crumbs of radio spectrum, they are refusing to acknowledge that the vast majority of the UHF TV channels are not even being used. Furthermore, cable television has made radio spectrum available in many portions of the country. Furthermore, new satellite line of sight systems will deliver entertainment on even other bands. The TV set in the writers home has never demodulated a program on any of the channels above channel 15. Most citizens in the USA never watch any broadcast TV on channels above channel 40 or even

devices, cordless PBXs, computer networks, cordless keyboards, and a variety of new and innovative ideas.

The United States government should recognize the enormous trade contribution being made by technical corporations, and:

1) Not tax them for new technology
2) Give them adequate spectrum

Comments on Technology

Our simulations prove that random entry of a new user in narrow band channels is a disaster. Our simulations also prove that monitoring before usage and spread spectrum both can increase spectrum efficiency by giant factors of five to ten times over and even more.

However, a poor monitoring system in narrow band channels is not as spectrally efficient as spread spectrum. The design of the monitoring protocol and monitoring algorithms is a very key element in spectrum efficiency. The proposals of both WINForum and Ericsson are a very important step in the right direction.

below emerges again and again.

For example, our computer simulations have shown the importance of monitoring before usage, and the importance of spread spectrum:

For example, in a decentralized system of 100 narrow band duplex channel pairs with random entry, the system collapses with only 3 local conversations. This is only 3 percent local utilization. Such a system could perhaps handle 100 simultaneous conversations in each area, but in reality, a new user coming on the air when there are three local conversations has about a three percent chance of causing/receiving interference, and this is an unacceptable level.

However, if the new users monitors before communications, the system can load to about 30% local capacity before interference gets above three percent. **This is a ten fold increase in spectrum efficiency by merely monitoring before usage!!!**

It is not the theoretical spectrum capacity that is important, but how many users can we put on the air before the interference becomes unacceptable.

Our simulations also indicate that spread spectrum is comparable to narrow band channels with monitoring. **There is a ten fold increase in spectrum efficiency by switching from random usage narrow band channels to spread spectrum.**

However, the story does not end there!! We have found that in duplex channel pairs four tests are required for the acceptable entry of a new user:

1) Will the new user pair's base receive interference?
2) Will the new user pair's remote receive interference?
3) Will an old remote receive interference from a new base?
4) Will an old base receive interference from a new remote?

These tests can be performed in a decentralized system with no signaling between new and old user pairs, and interference free assignments can be made.

Our simulations indicate that we can further triple the spectrum efficiency compared to either spread spectrum or monitoring by the addition of these four tests. **That is an increase in spectrum efficiency of about <u>thirty</u> <u>fold</u> over random entry!**

The following situation demonstrates how these tests can be

We monitor the set of available channels and we hear some weak signals on all of them. If we set a reuse threshold that is too high, we will perhaps cause/receive interference. If we set a threshold that is too low, we will not be able to find an open channel.

Suppose Base A is already talking to Remote A on channel pair 10. We hear them very weakly. We can measure our own signal strength and conclude that we could operate on this channel pair without receiving interference. However, how do we know whether we would interfere with them?

If Base A and Remote A add a tone (or digital data stream) to their conversation that indicates the signal strength that they are receiving from each other, we can then calculate whether we will interfere with them! The idea is simple, and the implementation is inexpensive, but the required protocols/calculations, etc. require detailed pages of explanation. (Reciprocity of signal paths, antennae gains, etc. etc. must be taken into consideration.)

We also have developed technology for Dynamic Code Assignment. In spread spectrum systems, similar codes frequently cause interference. We have developed simple and fast algorithms for dynamically creating a new code that has a maximum distance from all the other codes already in usage. This permits a new user to have a code that will not hurt other communicating users, and this new code is not susceptible to interference from the existing active users.

Respectively Submitted
ComRad Corporation
By: Jerry Schloemer

July 15, 1993
Comrad Corporation
Matrix Corporation
PO BOX 307
Round Lake, Illinois
60073